

## High voltage fast-switching NPN power transistor

### Features

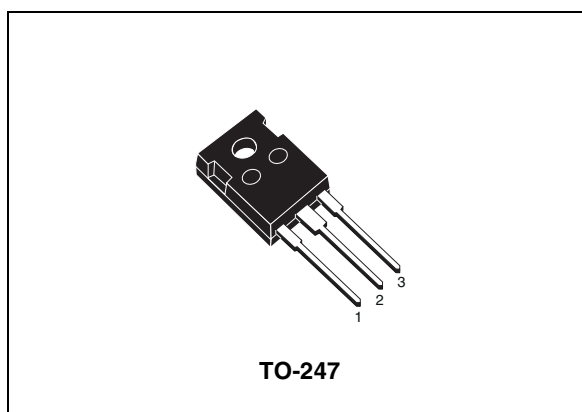
- High voltage capability
- Very high switching speed
- Minimum lot-to-lot spread for reliable operation
- Low base-drive requirements

### Applications

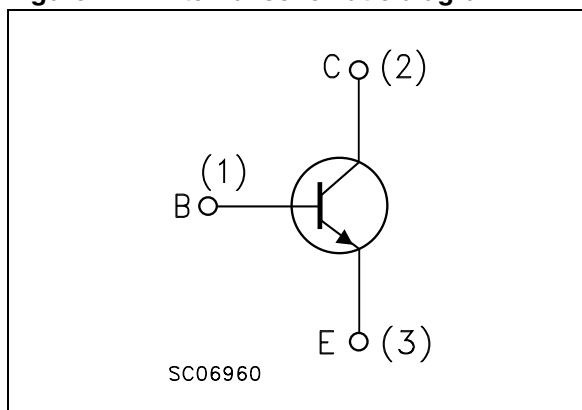
- Switch mode power supplies
- Motor control

### Description

The BUF410A is manufactured using high voltage multi epitaxial planar technology for high switching speeds and high voltage capacity. It uses a cellular emitter structure with planar edge termination to enhance switching speeds while maintaining a wide RBSOA.



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

Order code	Marking	Package	Packaging
BUF410A	BUF410A	TO-247	Tube

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CEV}$	Collector-emitter voltage ( $V_{BE} = -1.5$ V)	1000	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	450	V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	7	V
$I_C$	Collector current	15	A
$I_{CM}$	Collector peak current ( $t_P < 5$ ms)	30	A
$I_B$	Base current	3	A
$I_{BM}$	Base peak current ( $t_P < 5$ ms)	4.5	A
$P_{tot}$	Total dissipation at $T_C = 25$ °C	125	W
$T_{stg}$	Storage temperature	-65 to 150	°C
$T_J$	Max. operating junction temperature	150	°C

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1	°C/W

## 2 Electrical characteristics

( $T_{case} = 25\text{ °C}$  unless otherwise specified)

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{CER}$	Collector cut-off current ( $R_{BE} = 10\ \Omega$ )	$V_{CE} = 1000\text{ V}$ $V_{CE} = 1000\text{ V}$ $T_C = 100\text{ °C}$			0.2 1	mA mA
$I_{CEV}$	Collector cut-off current ( $V_{BE} = -1.5\text{ V}$ )	$V_{CE} = 1000\text{ V}$ $V_{CE} = 1000\text{ V}$ $T_C = 100\text{ °C}$			0.2 1	mA mA
$I_{EBO}$	Emitter cut-off current ( $I_C = 0$ )	$V_{EB} = 5\text{ V}$			1	mA
$V_{CEO(sus)}^{(1)}$	Collector-emitter sustaining voltage ( $I_B = 0$ )	$I_C = 200\text{ mA}$	450			V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	$I_E = 50\text{ mA}$	7			V
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C = 5\text{ A}$ $I_B = 0.5\text{ A}$ $I_C = 5\text{ A}$ $I_B = 0.5\text{ A}$ $T_C = 100\text{ °C}$ $I_C = 10\text{ A}$ $I_B = 2\text{ A}$ $I_C = 10\text{ A}$ $I_B = 2\text{ A}$ $T_C = 100\text{ °C}$		0.8 0.5	2.8 2	V V V
$V_{BE(sat)}^{(1)}$	Base-emitter saturation voltage	$I_C = 5\text{ A}$ $I_B = 0.5\text{ A}$ $I_C = 5\text{ A}$ $I_B = 0.5\text{ A}$ $T_C = 100\text{ °C}$ $I_C = 10\text{ A}$ $I_B = 2\text{ A}$ $I_C = 10\text{ A}$ $I_B = 2\text{ A}$ $T_C = 100\text{ °C}$		0.9 1.1	1.5 1.5	V V V
$di_c / dt$	Rate of rise on-state collector current	$V_{CC} = 300\text{ V}$ $R_C = 0$ $t_p = 3\ \mu\text{s}$ $I_{B1} = 0.75\text{ A}$ $T_C = 25\text{ °C}$ $I_{B1} = 0.75\text{ A}$ $T_C = 100\text{ °C}$ $I_{B1} = 3\text{ A}$ $T_C = 100\text{ °C}$	45 100	60		A/ $\mu\text{s}$ A/ $\mu\text{s}$ A/ $\mu\text{s}$
$V_{CE(dyn)}$	Collector-emitter dynamic voltage ( $3\ \mu\text{s}$ )	$V_{CC} = 300\text{ V}$ $R_C = 60\ \Omega$ $I_{B1} = 0.75\text{ A}$ $T_C = 25\text{ °C}$ $I_{B1} = 0.75\text{ A}$ $T_C = 100\text{ °C}$		2.1	8	V V
$V_{CE(dyn)}$	Collector-emitter dynamic voltage ( $5\ \mu\text{s}$ )	$V_{CC} = 300\text{ V}$ $R_C = 60\ \Omega$ $I_{B1} = 0.75\text{ A}$ $T_C = 25\text{ °C}$ $I_{B1} = 0.75\text{ A}$ $T_C = 100\text{ °C}$		1.1	4	V V
$t_s$	Inductive load Storage time	$I_C = 5\text{ A}$ $V_{CC} = 50\text{ V}$ $V_{BB} = -5\text{ V}$ $R_{BB} = 1.2\ \Omega$		0.8		$\mu\text{s}$
$t_f$	Fall time	$V_{Clamp} = 400\text{ V}$ $I_{B1} = 0.5\text{ A}$		0.05		$\mu\text{s}$
$t_c$	Cross over time	$L = 0.5\text{ mH}$		0.08		$\mu\text{s}$

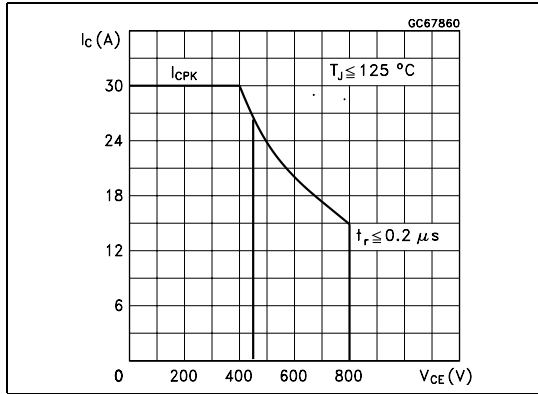
Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$t_s$	Inductive load Storage time	$I_C = 5\text{ A}$	$V_{CC} = 50\text{ V}$				
$t_f$	Fall time	$V_{BB} = -5\text{ V}$	$R_{BB} = 1.2\ \Omega$			1.8	$\mu\text{s}$
$t_c$	Cross over time	$V_{Clamp} = 400\text{ V}$	$I_{B1} = 0.5\text{ A}$			0.1	$\mu\text{s}$
		$L = 0.5\text{ mH}$	$T_C = 100\text{ }^\circ\text{C}$			0.18	$\mu\text{s}$
$V_{CEW}$	Maximum collector emitter voltage without snubber	$I_C = 5\text{ A}$	$V_{CC} = 50\text{ V}$	500			V
		$V_{BB} = -5\text{ V}$	$R_{BB} = 1.2\ \Omega$				
		$I_{B1} = 0.5\text{ A}$	$L = 0.5\text{ mH}$				
		$T_C = 125\text{ }^\circ\text{C}$					
$t_s$	Inductive load Storage time	$I_C = 5\text{ A}$	$V_{CC} = 50\text{ V}$				
$t_f$	Fall time	$V_{BB} = 0$	$R_{BB} = 0.3\ \Omega$		1.5		$\mu\text{s}$
$t_c$	Cross over time	$V_{Clamp} = 400\text{ V}$	$I_{B1} = 0.5\text{ A}$		0.04		$\mu\text{s}$
		$L = 0.5\text{ mH}$			0.07		$\mu\text{s}$
$t_s$	Inductive load Storage time	$I_C = 5\text{ A}$	$V_{CC} = 50\text{ V}$				
$t_f$	Fall time	$V_{BB} = 0$	$R_{BB} = 0.3\ \Omega$			3	$\mu\text{s}$
$t_c$	Cross over time	$V_{Clamp} = 400\text{ V}$	$I_{B1} = 0.5\text{ A}$			0.15	$\mu\text{s}$
		$L = 0.5\text{ mH}$	$T_C = 100\text{ }^\circ\text{C}$			0.25	$\mu\text{s}$
$V_{CEW}$	Maximum collector emitter voltage without snubber	$I_C = 5\text{ A}$	$V_{CC} = 50\text{ V}$	500			V
		$V_{BB} = 0$	$R_{BB} = 0.3\ \Omega$				
		$I_{B1} = 0.5\text{ A}$	$L = 0.5\text{ mH}$				
		$T_C = 125\text{ }^\circ\text{C}$					
$t_s$	Inductive load Storage time	$I_C = 10\text{ A}$	$V_{CC} = 50\text{ V}$				
$t_f$	Fall time	$V_{BB} = -5\text{ V}$	$R_{BB} = 1.2\ \Omega$		1.9		$\mu\text{s}$
$t_c$	Cross over time	$V_{Clamp} = 400\text{ V}$	$I_{B1} = 2\text{ A}$		0.06		$\mu\text{s}$
		$L = 0.25\text{ mH}$			0.12		$\mu\text{s}$
$t_s$	Inductive load Storage time	$I_C = 10\text{ A}$	$V_{CC} = 50\text{ V}$				
$t_f$	Fall time	$V_{BB} = -5\text{ V}$	$R_{BB} = 1.2\ \Omega$			3.2	$\mu\text{s}$
$t_c$	Cross over time	$V_{Clamp} = 400\text{ V}$	$I_{B1} = 2\text{ A}$			0.12	$\mu\text{s}$
		$L = 0.25\text{ mH}$	$T_C = 100\text{ }^\circ\text{C}$			0.3	$\mu\text{s}$
$V_{CEW}$	Maximum collector emitter voltage without snubber	$I_C = 15\text{ A}$	$V_{CC} = 50\text{ V}$	400			V
		$V_{BB} = -5\text{ V}$	$R_{BB} = 1.2\ \Omega$				
		$I_{B1} = 3\text{ A}$	$L = 0.1\text{ mH}$				
		$T_C = 125\text{ }^\circ\text{C}$					

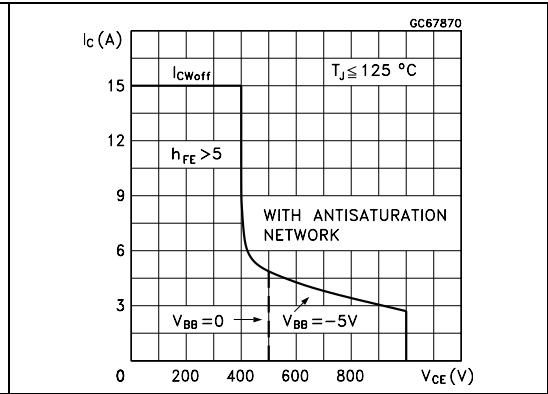
1. Pulse duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1.5\%$

## 2.1 Electrical characteristics (curves)

**Figure 2. Forward biased safe operating area**

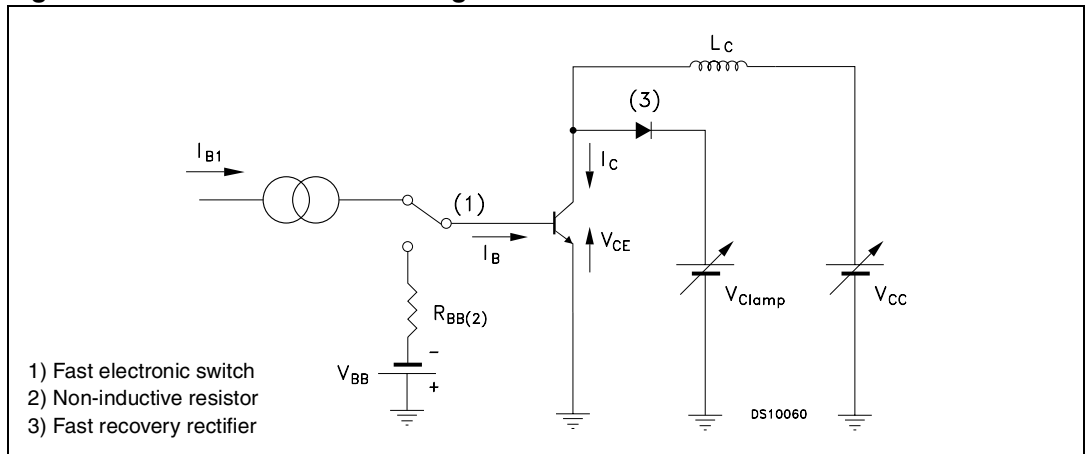


**Figure 3. Reverse biased safe operating area**



## 2.2 Test circuit

**Figure 4. Inductive load switching test circuit**

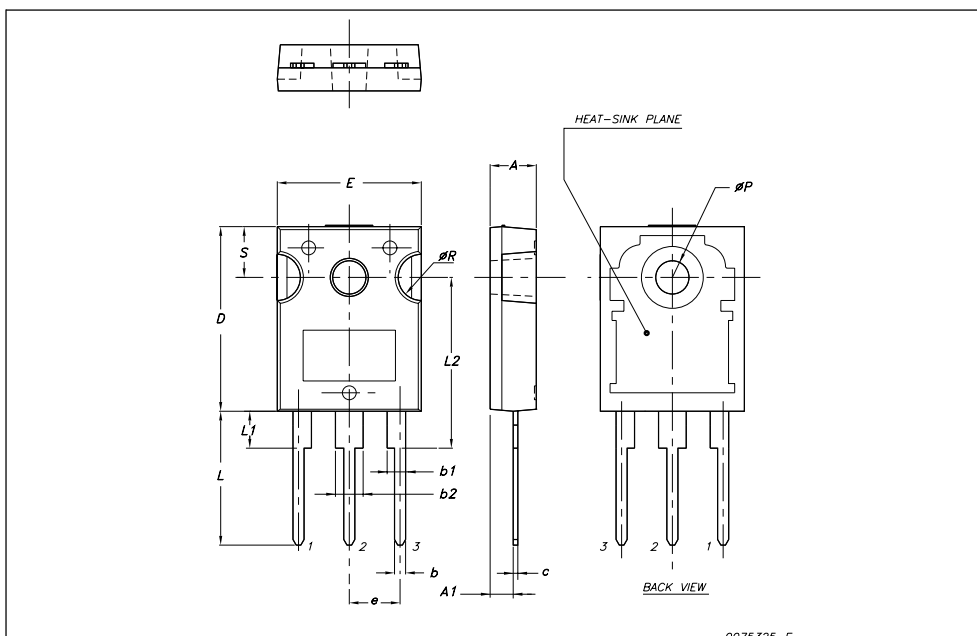


### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

**TO-247 Mechanical data**

Dim.	mm.		
	Min.	Typ	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



## 4 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
18-Mar-2002	2	
13-Mar-2008	3	Package change from TO-218 to TO-247.



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